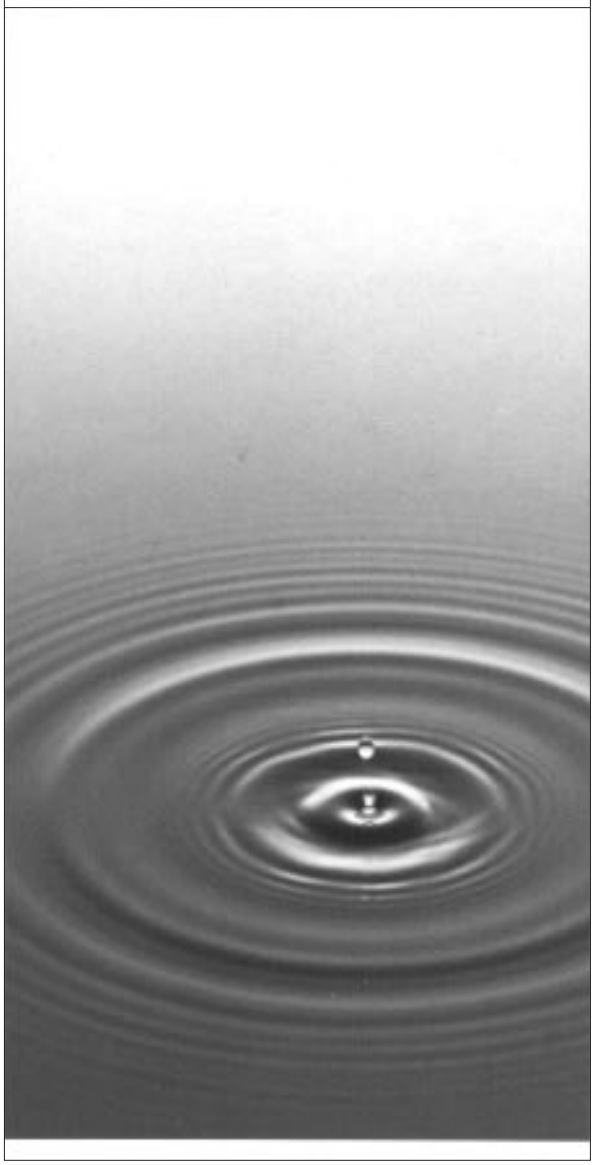
RICOH

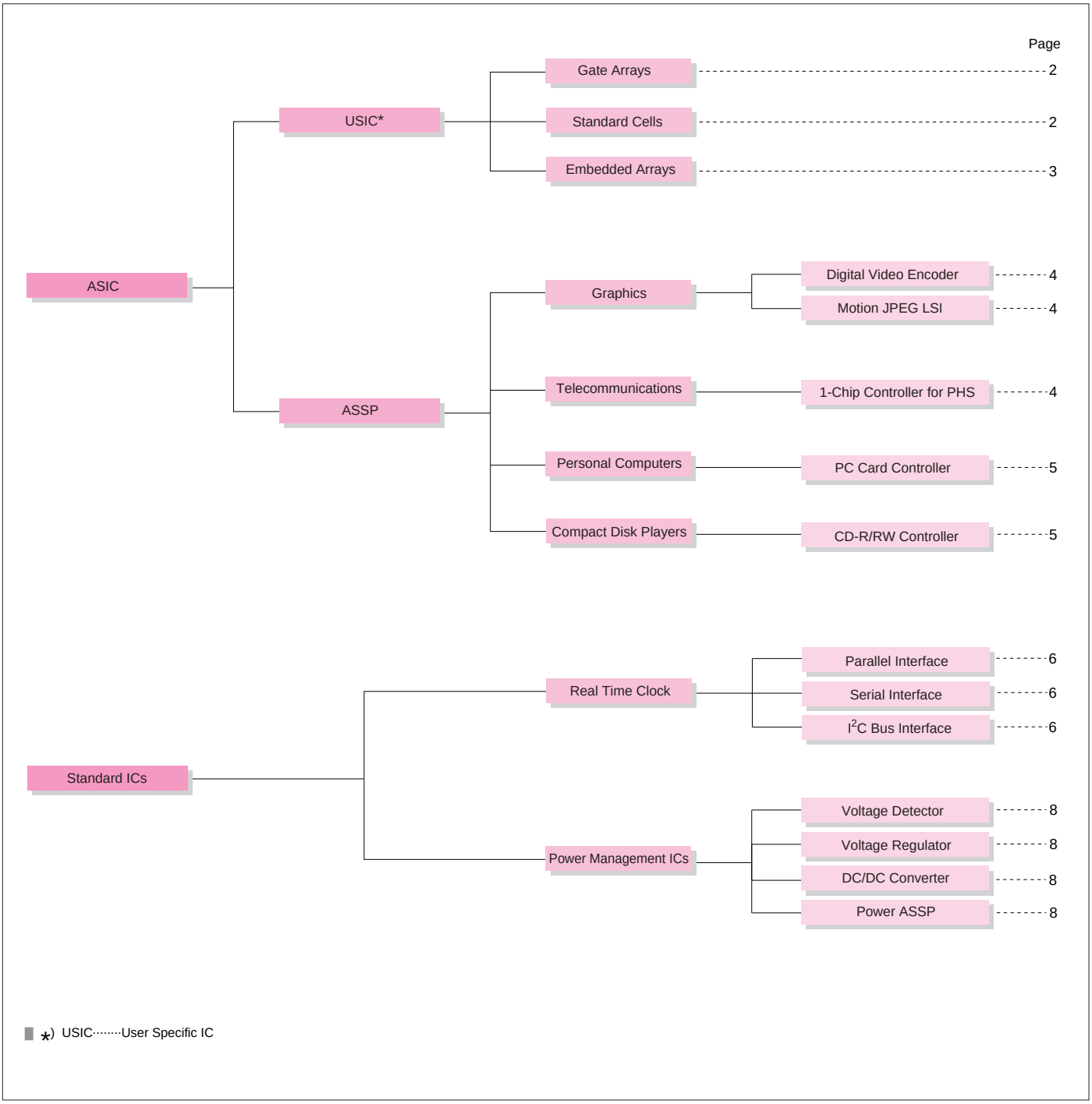
IC SHORT FORM CATALOG

WORKING TOGETHER
TO FIND SOLUTIONS



Product Lines

Ricoh offers a wide range of low power consumption, high performance CMOS ICs including ASIC, ASSP for multimedia application fields such as graphics, and telecommunications, and standard ICs such as voltage detectors, voltage regulators and DC/DC converters.



ASIC (USIC)

The cell libraries for gate arrays, standard cells, and embedded arrays are fully compatible.
The extensive cell libraries include CPU Core and DSP Core making system design more flexible.
Ricoh also offers mixed analog-digital ASIC devices with low voltage over 2.0V.

Gate Arrays

The gate arrays employ “sea-of-gates” architecture in “a Mega-Cell” enhanced to exploit the advantages of the extensive cell library including RAM, ROM, multiplier, barrel shifter, register file, etc.

5GU Series (0.8µm design rule)

Operating Voltage Range	I/O Interface	Gate Delay Time (TYP.)	Supply Current (TYP.)
2.7 to 3.3V	3V	0.63ns*1	7.7µW/MHz
4.5 to 5.5V	5V	0.38ns*1	—

∗1) Condition : 2 input power NAND, FAN OUT=2, wire length=2mm

5GU Series Master list

Master	5GU020	5GU030	5GU040	5GU050	5GU075	5GU100
Gates	21,976	33,000	43,092	54,016	82,056	109,080
Usable Gates	9,000	13,000	17,000	21,000	32,000	43,000
I/Os	136	164	188	208	256	292

Standard Cells

Numerous cells such as CPU Core, DSP Core, and analog cells can be built into one ASIC device. There are 2 types of 0.5µm ASIC devices a low power dissipation device or a high speed device.

RSC-08A Series (0.8µm design rule)

Operating Voltage Range	I/O Interface	Gate Delay Time (TYP.)	Supply Current (TYP.)
2.7 to 3.3V	3V	0.42ns*1	7.2µW/MHz
4.5 to 5.5V	5V	0.26ns*1	—

∗1) Condition : 2 input power NAND, FAN OUT=2, wire length=2mm

RSC-05 Series (0.5µm design rule)

Operating Voltage Range	I/O Interface	Gate Delay Time (TYP.)	Supply Current (TYP.)
2.0 to 3.3V	3V	0.39ns (3V)*1	2.84µW/MHz*2
3.0 to 3.6V	3.3V/5V	0.35ns (3V)*1	3.47µW/MHz*2

∗1) Condition : 2 input power NAND, FAN OUT=2, wire length=2mm
∗2) Condition : 2 input NAND, FAN OUT=2, wire length=2mm

RSC-05HS Series (0.5µm design rule)

Operating Voltage Range	I/O Interface	Gate Delay Time (TYP.)	Supply Current (TYP.)
3.0 to 3.6V	3.3V/5V	0.29ns (3.3V)*1	3.42µW/MHz (3.3V)*2

∗1) Condition : 2 input power NAND, FAN OUT=2, wire length=2mm
∗2) Condition : 2 input NAND, FAN OUT=2, wire length=2mm

RSC-035 Series (0.35µm design rule)

Operating Voltage Range	I/O Interface	Gate Delay Time (TYP.)	Supply Current (TYP.)
1.8 to 3.6V	1.8 to 3.6V	0.23ns (3.3V)*1	1.37µW/MHz (3.3V)*1

∗1) Condition : 2 input power NAND, FAN OUT=2, standard wire load

Embedded Arrays

The embedded arrays have the advantage of both gate arrays and standard cells, enabling customers to expedite their product development schedules, and offering designs with greater flexibility.
Mega-cells for standard cell devices can be built into one chip.

REA-05 Series (0.5µm design rule)

Operating Voltage Range	I/O Interface	Gate Delay Time (TYP.)	Supply Current (TYP.)
2.0 to 3.3V	3V	0.43ns (3V)*1	2.7µW/MHz (3V)
3.0 to 3.6V	3.3V/5V	0.38ns (3.3V)*1	3.4µW/MHz (3.3V)

∗1) Condition : 2 input NAND, FAN OUT=2, wire length=2mm

REA-05HS Series (0.5µm design rule)

Operating Voltage Range	I/O Interface	Gate Delay Time (TYP.)	Supply Current (TYP.)
3.0 to 3.6V	3.3V/5V	0.32ns*1	3.3µW/MHz

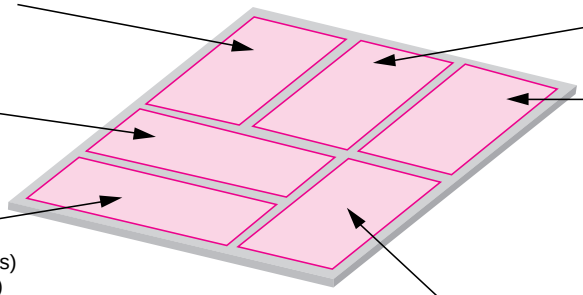
∗1) Condition : 2 input NAND, FAN OUT=2, wire length=2mm

Total-System-On-A-Chip Level of Integration

CPU Core Cells/DSP Core Cells
- Ru6 CPU Core (8bit)
- Ru8 CPU Core (8bit Ricoh original architecture)
- Ru16 CPU Core (16bit Ricoh original architecture)
- Ru30 CPU Core (32bit Ricoh original architecture)
- Rd17 DSP Core (16 ×16→32)
- Rd30 DSP Core (16 ×16→40)

User Logic
- Macro Cells
- Macro Function Cells

Compiled Cells
- MRO (Mask-ROM asynchronous)
- NRO (Mask-ROM synchronous)
- VSR/HSR (SRAM synchronous)
- SRA (SRAM asynchronous)
- MUL (Multiplier)
- RGF (Register File)
- RSR (Register Bank for Ru30)



CPU Peripheral Cells
- ACI (Asynchronous communication interface)
- INTC (Interrupt controller)
- TCC (Timer/Counter)
- RTC (Real Time Clock)
- BREP (Bus Repeater)

Analog Cells
- 8bit A/D Converter
- 10bit A/D Converter
- 8bit D/A Converter
- 10bit D/A Converter
- Op-Amp
- Low Power Consumption Comparator
- High Accuracy Comparator
- High Speed Comparator
- I/O Cell Type Comparator
- Comparator with Hysteresis
- PLL
- Analog Switch
- Voltage Comparator
- Voltage Reference

Memory Module
- SRA (Asynchronous high speed SRAM)
- FIFO (Line memory)
- EPROM

Multi-function Mega Cells can be customized to meet a wide range of customer needs. Your desired system can be put into a one-chip format accommodating both digital and analog and operating at 2V.

ASSP

Ricoh offers a full spectrum of multimedia products including graphics, telecommunications, PC, and CD systems.

GRAPHICS

Digital Video Encoder

M/NTSC or B, D, G, H/PAL Composite Video Output support. All digital processing in color conversion, filtering, and modulation enables output signal to be accurate with less cross color noise.

Item	Input signals			Pixel rate				Output signals		8bit DAC	Power Supply Voltage			Package
	24bits RGB	8bits YCbCr	16bits YCbCr	13.5 MHz	14.32 MHz	17.73 MHz	14.19 MHz	Analog Y/C	Analog Composite Video		Digital Block	Analog Block	I/O Block	
RL5C292-001	O	-	O	O	-	-	-	O	O	3channels	3.3V±0.3V	5.0V±0.5V	-	64LQFP
RL5C292-002 RF5C292-002	O	-	O	O	-	-	-	-	O	1channel	3.3V±0.3V 5.0V±0.5V	5.0V±0.5V	-	64LQFP 64QFP
RL5C293 RF5C293	O	-	O	O	O	O	O	-	O	1channel	3.3V±0.3V 5.0V±0.5V	5.0V±0.5V	-	64LQFP 64QFP
RL5C295*1	-	O	O	O	-	-	-	O	O	3channels	3.3V±0.3V	5.0V±0.5V	3.3V±0.3V 5.0V±0.5V	44LQFP

*1) Input clock frequency is 27MHz.

Motion JPEG LSI

One-chip JPEG LSI incorporating DCT/IDCT and Haffman Encode/Decode functions compliant with H.261 and JPEG base line system.

Item	Functions	Power Supply Voltage	Operating Frequency	Operation Time	Package
RL5V833	Interleave, Noninterleave support. Support Scale factor function for compression rate control. Supports Processing Marker codes in compressed data playing 30 frames/sec moving pictures.	3.3V±10%	28.6MHz(MAX.)	Approximately 0.02sec. when operating at 28.6MHz VGA (640×480)*1	64LQFP

*1) Reference value, which only indicates the capability of the RL5V833 itself.

TELECOMMUNICATIONS

One-chip controller for PHS (Personal Handy phone System)

One-chip solution for PHS Base-band functions, consisting of ADPCM CODEC, π/4 Shift-QPSK modem, 16bit CPU Core, Channel Codec, ADC, DAC.

Item	Functions	Power Supply Voltage	Package
RT5A180	ADPCM CODEC : ITU-T G.726 compliant, built-in DTMF and other tone generator circuit. π/4 Shift-QPSK modem : 10.8M/1.2M modulate wave IF input. Built-in 16bit CPU Core, Channel Codec, 32kB RAM. Data transfer rate : 32kbps.	2.7V to 3.6V	144TQFP

PC

PC Card Controller (For ISA Bus)

Ricoh offers a wide range of PC card controllers which support 1-slot or 2-slot, and various packages, and are compliant with PCMCIA2.1/JEIDA4.2 for personal computers.

Item	Functions	Power Supply Voltage	Slot	Maximum Operating Frequency	Operating Current	Stand-by Current	Package
RF5C296 RB5C296	ISA-PCMCIA bridge compliant with PCMCIA2.1/JEIDA4.2 and "YENTA" register sets. Direct connection to ISA Bus. Level interrupt in non-ISA Interface is available. Mixed Voltage Operation (3.3V/5V).	5V±10% 3.3V±0.3V	1	11MHz	15mA	20µA	144LQFP 144PBGA
RF5C396L RF5C396 RB5C396		5V±10% 3.3V±0.3V	2	11MHz	30mA	20µA	208LQFP 208QFP 256PBGA

PC Card Controller (For PCI Bus)

Ricoh offers a wide range of PC card controllers which support 1-slot or 2-slot, Distributed DMA, ZVport, etc., and are compliant with PCMCIA2.1/JEIDA4.2 and other related standards for personal computers.

Item	Functions	Power Supply Voltage	Slot	Maximum Operating Frequency	Operating Current	Stand-by Current	Package
RL5C476	PCI-CardBus Bridge compliant with PC Card 95 and PCI local Bus 2.1. PC97 compliant. ACPI support.	5V±5% 3.3V±0.3V	2	33MHz	90mA	10µA	208LQFP
RL5C475 RC5C475*1 RT5C475*1	Single slot PCI-CardBus Bridge.	5V±5% 3.3V±0.3V	1	33MHz	60mA	10µA	144LQFP 144CSP*1 144TQFP*1
RB5C478 RL5C478*1	Enhanced PCI-CardBus Bridge, built in ZVport buffer.	5V±5% 3.3V±0.3V	2	33MHz	90mA	10µA	261PBGA 256LQFP*1

*1) Under development

CD

CD-R/RW Controller

Data processing LSI for CD-R (Recordable) /CD-RW (ReWritable) system compliant with ATAPI for CD-ROM Rev.2.6 (SEF-8020)/SCSI Controller DMA Bus Interface.

Item	Functions	Package
RL5E808	Supports EFM encode, CD-ROM encode/decode and ATIP decode functions, enabling the production of a CD-R/RW drive by only adding DSP for decode. Encode : up to 8x speed / Decode : up to 32x speed.	176LQFP

Real-Time Clock ICs

Ricoh's Standard ICs is utilized wide range of uses to include Real Time Clock ICs and Power Management ICs.

Real Time Clock

Ricoh offers both Parallel Interface and Serial Interface Real Time Clock (RTC), which enable to improve portable telecommunication products such as PDAs, pagers, and cellular phones with small package and low power consumption.

Item	Functions	Power Supply Voltage	Time Keeping Voltage	Standby Current	Package
RP5C01A RF5C01A	4bit Parallel RTC. Direct CPU connection. Embedded 26×4bit RAM.	4.5V to 5.5V	2.2V to 5.5V*1	15µA(MAX.)	18DIP 18SOP
RP5C15 RF5C15 RJ5C15	4bit Parallel RTC. Direct CPU connection.	5V to 5.5V	2.0V to 5.5V*1	15µA(MAX.)	18DIP 18SOP 28PLCC
RP5C62 RF5C62 RS5C62	4bit Parallel RTC. Direct CPU connection. Low power consumption. High accuracy ensured by oscillator's fixed voltage operation.	2.0V to 6.0V	2.7V to 6.0V	3µA(MAX.)	18DIP 18SOP 20SSOP
RS5C313	Serial Interface RTC.	2.7V to 6.0V	1.6V to 6.0V	0.7µA(TYP.)	8SSOP
RS5C314	Reversed Shift-Clock of RS5C313.	2.7V to 6.0V	1.6V to 6.0V	0.7µA(TYP.)	8SSOP
RS5C316A	Serial Interface RTC with Alarm function.	2.7V to 6.0V	1.6V to 6.0V	0.6µA(TYP.)	8SSOP
RS5C316B	Reversed Shift-Clock of RS5C316A.	2.7V to 6.0V	1.6V to 6.0V	0.6µA(TYP.)	8SSOP
RS5C317A	Serial Interface RTC with Alarm, timer, and 32kHz output pin.	2.7V to 6.0V	1.6V to 6.0V	0.6µA(TYP.)	14SSOP
RS5C317B	Reversed Shift-Clock RTC of RS5C317A.	2.7V to 6.0V	1.6V to 6.0V	0.6µA(TYP.)	14SSOP
RS5C321A	Serial Interface RTC with 32kHz output pin.	2.7V to 6.0V	1.6V to 6.0V	0.6µA(TYP.)	8SSOP
RS5C321B	Reversed Shift-Clock RTC of RS5C321A.	2.7V to 6.0V	1.6V to 6.0V	0.6µA(TYP.)	8SSOP
RS5C372A	I^2C Bus Interface*2 RTC with 2 alarms, 32kHz output pin (open-drain) and high precision clock error adjustment circuit.	2.0V to 6.0V	1.45V to 6.0V	0.5µA(TYP.)	8SSOP
RS5C372B	32kHz output pin (CMOS) of RS5C372A.	2.0V to 6.0V	1.45V to 6.0V	0.5µA(TYP.)	8SSOP
RS5C373A	Built-in supply voltage detector into RS5C372A.	2.0V to 6.0V	1.45V to 6.0V	0.7µA(TYP.)	8SSOP

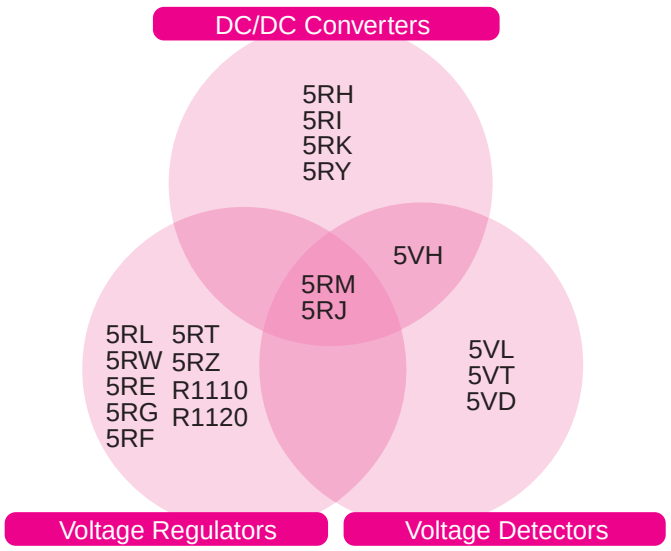
*1) Voltage for preserve data

*2) I^2CBus is a trademark of PHILIPS ELECTRONICS N.V.
Purchase of I^2C components of Ricoh Company, Ltd. conveys a license under the Philips I^2C Patent Rights to use these components in an I^2C system, provided that the system comforms to the I^2C Standard Specification as defined by Philips.

Power Management ICs

A small, reliable power management IC is now a prerequisite for every one of today's compact, battery-powered electronic devices. Ricoh has developed an impressive line-up of multi-purpose CMOS Power Management ICs offering low supply current, high accuracy, high performance, and exceptionally small packages.

Product Line-up



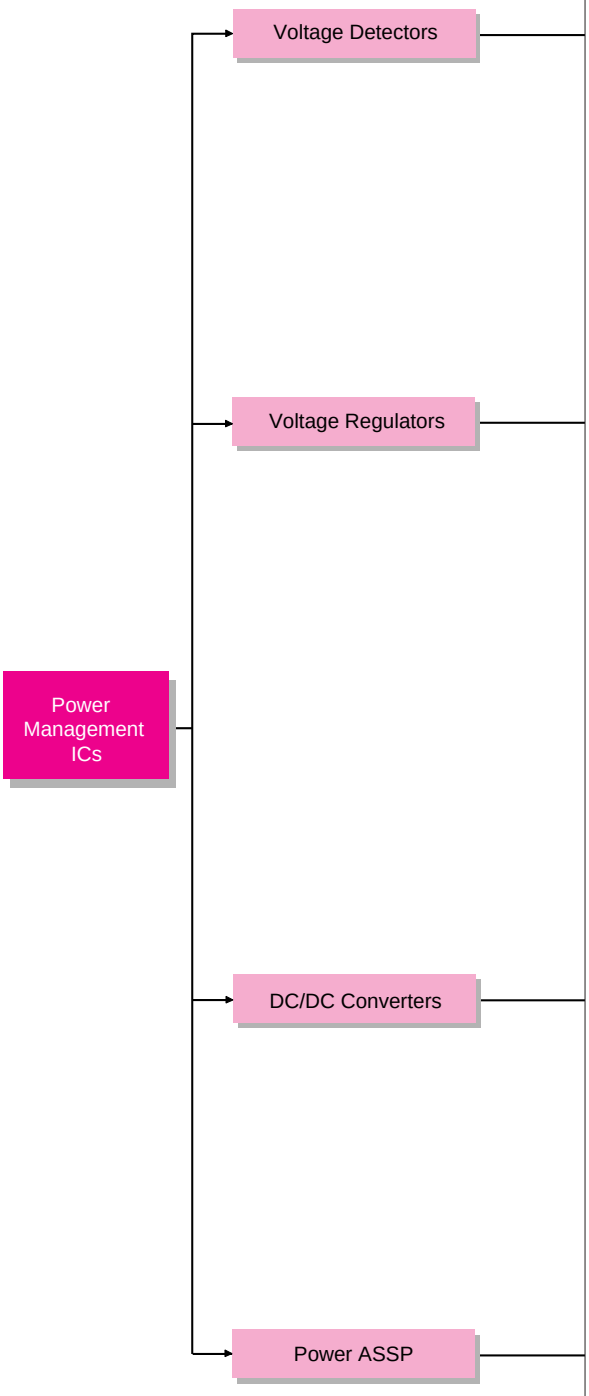
Power ASSP

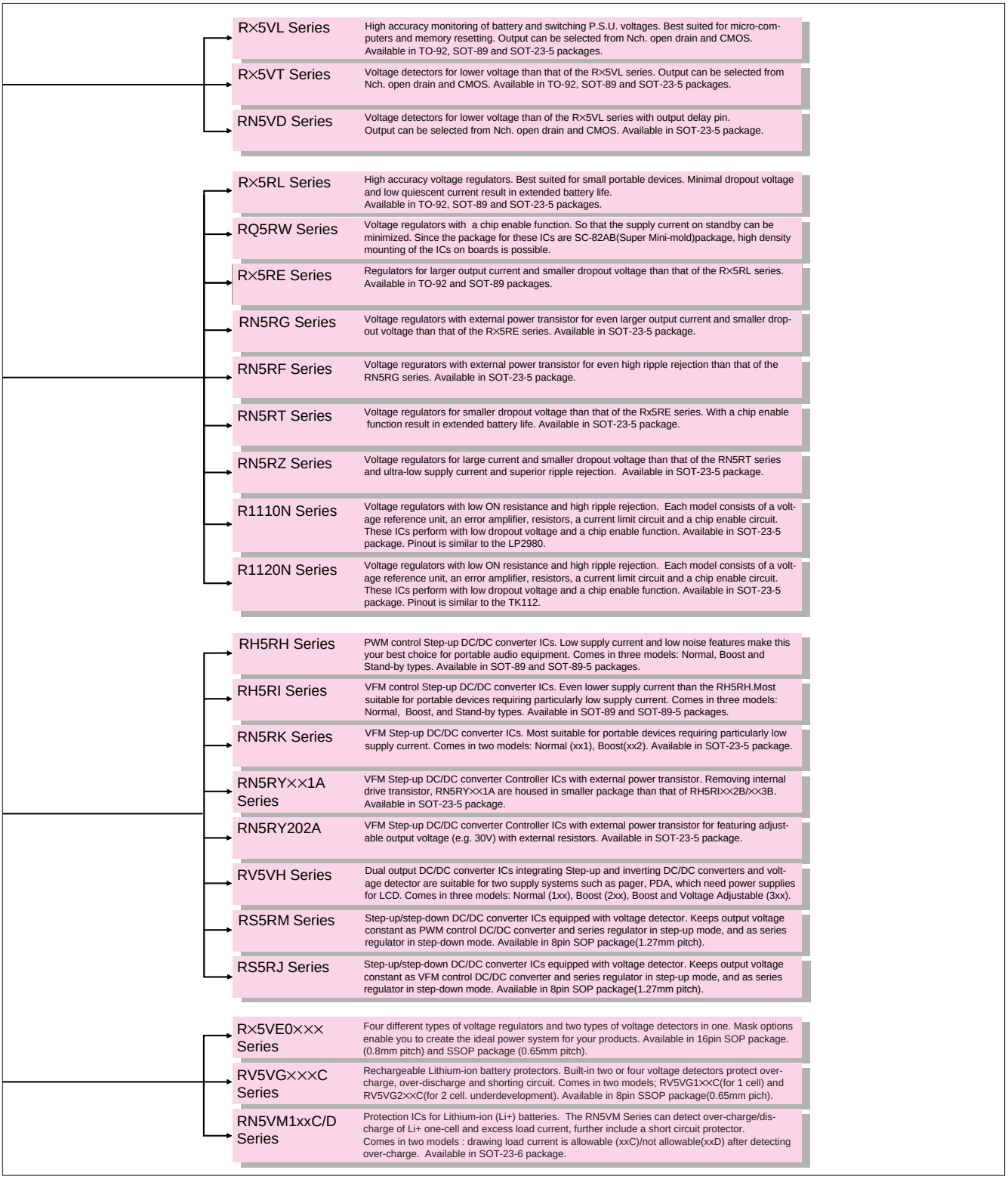
For Cellular Phone
Li-Ion Battery Protector

R×5VE0×××Series
RV5VG×××C Series
RN5VM1×××C/D Series

*) All Ricoh Power Management ICs are CMOS. Ricoh's advanced laser trimming technology has made a stepwise setting with a step of 0.1V and a high accuracy ±2.5% voltage possible.
(Only RN5VS is ±3.0%)

Power Management IC Series Descriptions




R×5VL Series
High accuracy monitoring of battery and switching P.S.U. voltages. Best suited for micro-computers and memory resetting. Output can be selected from Nch. open drain and CMOS. Available in TO-92, SOT-89 and SOT-23-5 packages.
R×5VT Series
Voltage detectors for lower voltage than that of the R×5VL series. Output can be selected from Nch. open drain and CMOS. Available in TO-92, SOT-89 and SOT-23-5 packages.
RN5VD Series
Voltage detectors for lower voltage than of the R×5VL series with output delay pin. Output can be selected from Nch. open drain and CMOS. Available in SOT-23-5 package.
R×5RL Series
High accuracy voltage regulators. Best suited for small portable devices. Minimal dropout voltage and low quiescent current result in extended battery life. Available in TO-92, SOT-89 and SOT-23-5 packages.
RQ5RW Series
Voltage regulators with a chip enable function. So that the supply current on standby can be minimized. Since the package for these ICs are SC-82AB(Super Mini-mold)package, high density mounting of the ICs on boards is possible.
R×5RE Series
Regulators for larger output current and smaller dropout voltage than that of the R×5RL series. Available in TO-92 and SOT-89 packages.
RN5RG Series
Voltage regulators with external power transistor for even larger output current and smaller dropout voltage than that of the R×5RE series. Available in SOT-23-5 package.
RN5RF Series
Voltage regurators with external power transistor for even high ripple rejection than that of the RN5RG series. Available in SOT-23-5 package.
RN5RT Series
Voltage regulators for smaller dropout voltage than that of the Rx5RE series. With a chip enable function result in extended battery life. Available in SOT-23-5 package.
RN5RZ Series
Voltage regulators for large current and smaller dropout voltage than that of the RN5RT series and ultra-low supply current and superior ripple rejection. Available in SOT-23-5 package.
R1110N Series
Voltage regulators with low ON resistance and high ripple rejection. Each model consists of a voltage reference unit, an error amplifier, resistors, a current limit circuit and a chip enable circuit. These ICs perform with low dropout voltage and a chip enable function. Available in SOT-23-5 package. Pinout is similar to the LP2980.
R1120N Series
Voltage regulators with low ON resistance and high ripple rejection. Each model consists of a voltage reference unit, an error amplifier, resistors, a current limit circuit and a chip enable circuit. These ICs perform with low dropout voltage and a chip enable function. Available in SOT-23-5 package. Pinout is similar to the TK112.
RH5RH Series
PWM control Step-up DC/DC converter ICs. Low supply current and low noise features make this your best choice for portable audio equipment. Comes in three models: Normal, Boost and Stand-by types. Available in SOT-89 and SOT-89-5 packages.
RH5RI Series
VFM control Step-up DC/DC converter ICs. Even lower supply current than the RH5RH.Most suitable for portable devices requiring particularly low supply current. Comes in three models: Normal, Boost, and Stand-by types. Available in SOT-89 and SOT-89-5 packages.
RN5RK Series
VFM Step-up DC/DC converter ICs. Most suitable for portable devices requiring particularly low supply current. Comes in two models: Normal (xx1), Boost(xx2). Available in SOT-23-5 package.
RN5RY××1A Series
VFM Step-up DC/DC converter Controller ICs with external power transistor. Removing internal drive transistor, RN5RY××1A are housed in smaller package than that of RH5RI××2B/××3B. Available in SOT-23-5 package.
RN5RY202A
VFM Step-up DC/DC converter Controller ICs with external power transistor for featuring adjustable output voltage (e.g. 30V) with external resistors. Available in SOT-23-5 package.
RV5VH Series
Dual output DC/DC converter ICs integrating Step-up and inverting DC/DC converters and voltage detector are suitable for two supply systems such as pager, PDA, which need power supplies for LCD. Comes in three models: Normal (1xx), Boost (2xx), Boost and Voltage Adjustable (3xx).
RS5RM Series
Step-up/step-down DC/DC converter ICs equipped with voltage detector. Keeps output voltage constant as PWM control DC/DC converter and series regulator in step-up mode, and as series regulator in step-down mode. Available in 8pin SOP package(1.27mm pitch).
RS5RJ Series
Step-up/step-down DC/DC converter ICs equipped with voltage detector. Keeps output voltage constant as VFM control DC/DC converter and series regulator in step-up mode, and as series regulator in step-down mode. Available in 8pin SOP package(1.27mm pitch).
R×5VE0××× Series
Four different types of voltage regulators and two types of voltage detectors in one. Mask options enable you to create the ideal power system for your products. Available in 16pin SOP package. (0.8mm pitch) and SSOP package (0.65mm pitch).
RV5VG×××C Series
Rechargeable Lithium-ion battery protectors. Built-in two or four voltage detectors protect over-charge, over-discharge and shorting circuit. Comes in two models; RV5VG1××C(for 1 cell) and RV5VG2××C(for 2 cell. underdevelopment). Available in 8pin SSOP package(0.65mm pich).
RN5VM1xxC/D Series
Protection ICs for Lithium-ion (Li+) batteries. The RN5VM Series can detect over-charge/discharge of Li+ one-cell and excess load current, further include a short circuit protector. Comes in two models : drawing load current is allowable (xxC)/not allowable(xxD) after detecting over-charge. Available in SOT-23-6 package.

NOTICE

1. The products and the product specifications described in this document are subject to change or discontinuation of production without notice for reasons such as improvement. Therefore, before deciding to use the products, please refer to Ricoh sales representatives for the latest information thereon.

2. This document may not be copied or otherwise reproduced in whole or in part without prior written consent of Ricoh.

3. Please be sure to take any necessary formalities under relevant laws or regulations before exporting or otherwise taking out of your country the products or the technical information described herein.

4. The technical information described in this document shows typical characteristics of and example application circuits for the products. The release of such information is not to be construed as a warranty of or a grant of license under Ricoh's or any third party's intellectual property rights or any other rights.

5. The products listed in this document are intended and designed for use as general electronic components in standard applications (office equipment, computer equipment, measuring instruments, consumer electronic products, amusement equipment etc.). Those customers intending to use a product in an application requiring extreme quality and reliability, for example, in a highly specific application where the failure or misoperation of the product could result in human injury or death (aircraft, spacevehicle, nuclear reactor control system, traffic control system, automotive and transportation equipment, combustion equipment, safety devices, life support system etc.) should first contact us.

6. We are making our continuous effort to improve the quality and reliability of our products, but semiconductor products are likely to fail with certain probability. In order prevent any injury to persons or damages to property resulting from such failure, customers should be careful enough to incorporate safety measures in their design, such as redundancy feature, fire-containment feature and fail-safe feature. We do not assume any liability or responsibility for any loss or damage arising from misuse or inappropriate use of the products.

7. Anti-radiation design is not implemented in the products described in this document.

8. Please contact Ricoh sales representatives should you have any questions or comments concerning the products or the technical information.

June 1995

RICOH COMPANY, LTD.
ELECTRONIC DEVICES DIVISION

HEADQUARTERS
13-1, Himemuro-cho, Ikeda City, Osaka 563-8501, JAPAN
Phone 81-727-53-1111 Fax 81-727-53-6011

YOKOHAMA OFFICE (International Sales)
3-2-3, Shin-Yokohama, Kohoku-ku, Yokohama City, Kanagawa 222-8530, JAPAN
Phone 81-45-477-1697 Fax 81-45-477-1694 · 1695

http://www.ricoh.co.jp/LSI/english/

RICOH CORPORATION
ELECTRONIC DEVICES DIVISION

SAN JOSE OFFICE
3001 Orchard Parkway, San Jose, CA 95134-2088, U.S.A.
Phone 1-408-432-8800 Fax 1-408-432-8375

http://www.ricoh-usa.com/semicond.htm

EG-004-9804